10/512117

Best Available Copy

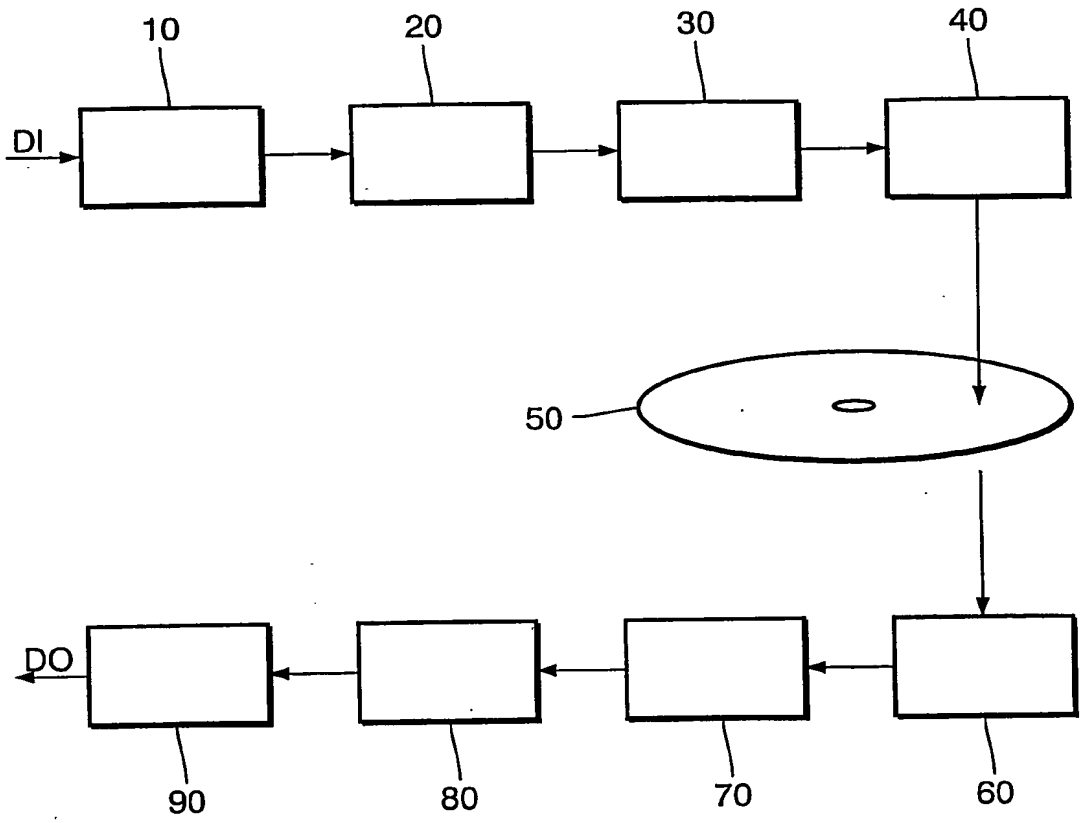

FIG.1

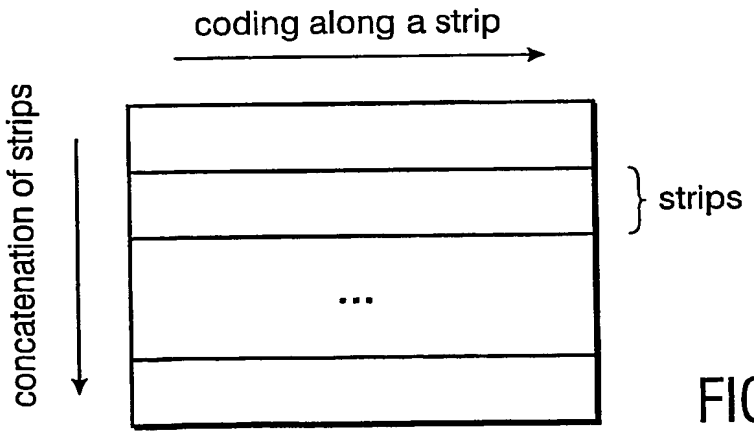

FIG.2

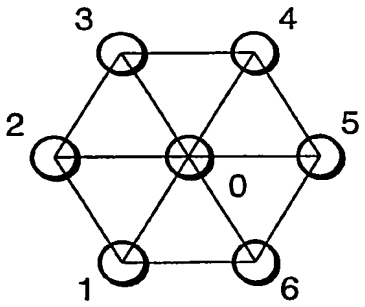

FIG.3A

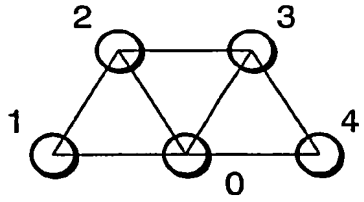

FIG.3B

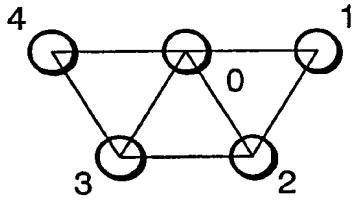

FIG.3C

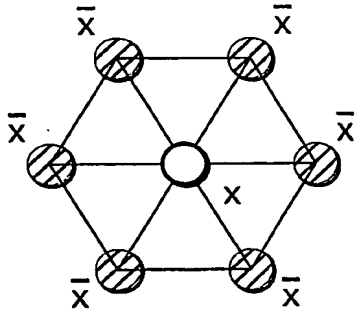

FIG.4A

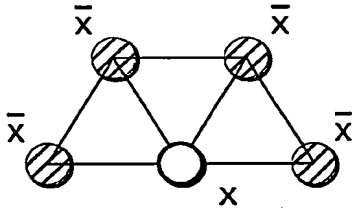

FIG.4B

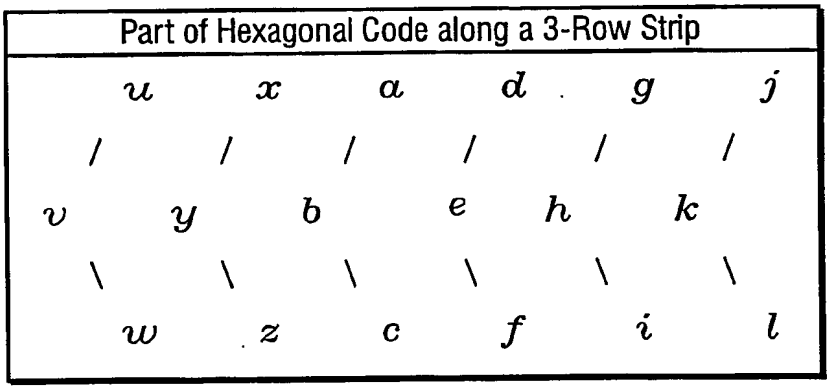
Part of Hexagonal Code along a 3-Row Strip
u x a d g j
/ / / / / /
v y b e h k
\ \ \ \ \ \
w z c f i l

FIG.5A

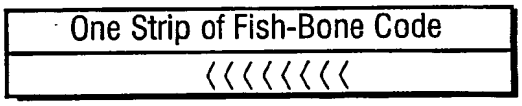
One Strip of Fish-Bone Code

FIG.5B

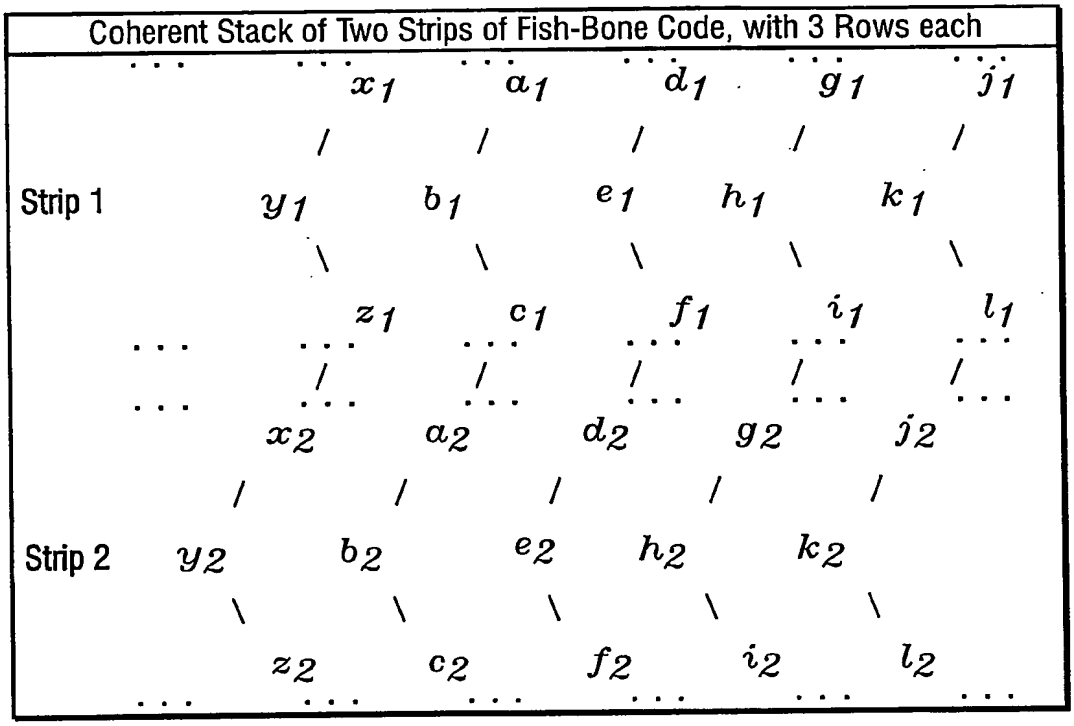
Coherent Stack of Two Strips of Fish-Bone Code, with 3 Rows each
Strip 1
Strip 2

FIG.6A

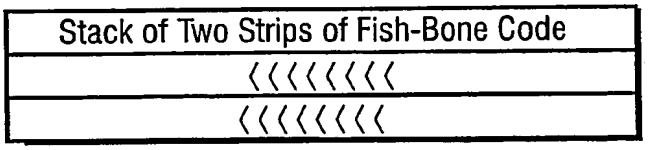
Stack of Two Strips of Fish-Bone Code

FIG.6B

Isolated Bit in Boundary Row	
Isolated and Surrounded Bits	Forbidden Next Triplets
x_s $\overline{x}_i$ / / . x_s \ \ . .	x_s / x_s \ .

FIG.7A

Isolated Bit in Central Row	
Isolated and Surrounded Bits	Forbidden Next Triplets
x_s x_s / / x_s $\overline{x}_i$ \ \ x_s x_s	. / x_s \ .

FIG.7B

STD-State without Isolated Bits			
STD-State σ_1	STD-State σ_2	STD-State σ_3	STD-State σ_4
x_s / x_s \ x_s	x_s / y_s \ y_s	x_s / y_s \ x_s	x_s / x_s \ y_s

FIG.8

STD-States with a Single Isolated Bit				
(related to σ_2)	(related to σ_3)			(related to σ_4)
STD-State σ_5	STD-State σ_6	STD-State σ_7	STD-State σ_8	STD-State σ_9
x_i / y_s \ y_s	x_i / y_s \ x_s	x_s / y_i \ x_s	x_s / y_s \ x_i	x_s / x_s \ y_i

FIG.9

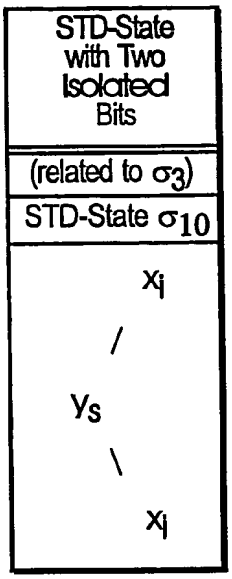

FIG.10

M = 8-ary NRZ Channel Symbol [l] = (ijk), with $l = i + 2j + 4k$, $0 \le l \le 7$		
Current NRZI Triplet	Channel Symbol [l]	Next NRZI Triplet
x_1 / y_1 \ z_1	$\rightarrow i \rightarrow$ $\rightarrow j \rightarrow$ $\rightarrow k \rightarrow$	$x_2 = x_1(-1)^i$ / $y_2 = y_1(-1)^j$ \ $z_2 = z_1(-1)^k$

FIG.11

M = 8-ary NRZ Channel Symbol Example for l = 6		
Current NRZI Triplets	Channel Symbol [l], l = 6	Next NRZI Triplet
1 / 0 \ 1	→ 0 →	1 / 1 \ 0
	→ 1 →	
	→ 1 →	

FIG.12

Flow of Channel Symbols in STD: Next States								
Starting State	Symbol [0]	Symbol [1]	Symbol [2]	Symbol [3]	Symbol [4]	Symbol [5]	Symbol [6]	Symbol [7]
σ_1	σ_1	σ_5	σ_7	σ_4	σ_9	σ_{10}	σ_2	σ_1
σ_2	σ_2	σ_1	σ_4	σ_6	σ_8	σ_9	σ_1	σ_5
σ_3	σ_3	σ_4	σ_1	σ_5	σ_2	σ_1	σ_9	σ_{10}
σ_4	σ_4	σ_6	σ_2	σ_1	σ_1	σ_5	σ_8	σ_9
σ_5	σ_2	–	σ_4	σ_6	σ_8	–	σ_1	σ_5
σ_6	σ_3	–	σ_1	σ_5	σ_2	–	σ_9	σ_{10}
σ_7	σ_3	σ_4	–	–	σ_2	σ_1	–	–
σ_8	σ_3	σ_4	σ_1	σ_5	–	–	σ_9	σ_{10}
σ_9	σ_4	σ_6	σ_2	σ_1	–	–	σ_8	σ_9
σ_{10}	σ_3	–	σ_1	σ_5	–	–	σ_9	σ_{10}

FIG.13

2D Code with $N_{nn} = 1$ and $N_{row} = 3$		
Code Mapping $m \rightarrow 3n$	Code Rate R	Efficiency $\eta = \frac{R}{C}$
$1 \rightarrow 3$	0.333333	0.3592
$2 \rightarrow 3$	0.666667	0.7184
$5 \rightarrow 6$	0.833333	0.8979
$8 \rightarrow 9$	0.888889	0.9578
$11 \rightarrow 12$	0.916667	0.9877
$25 \rightarrow 27$	0.925926	0.9977

FIG.14

Permutation of Channel Symbols related to Mirror Symmetry		
[0]	↔	[0]
[1]	↔	[4]
[2]	↔	[2]
[3]	↔	[6]
[4]	↔	[1]
[5]	↔	[5]
[6]	↔	[3]
[7]	↔	[7]

FIG.15A

Permutation of Next States related to Mirror Symmetry		
σ_1	↔	σ_1
σ_2	↔	σ_4
σ_3	↔	σ_3
σ_4	↔	σ_2
σ_5	↔	σ_9
σ_6	↔	σ_8
σ_7	↔	σ_7
σ_8	↔	σ_6
σ_9	↔	σ_5
σ_{10}	↔	σ_{10}

FIG.15B

16-State FSM Fish-Bone **Main Code** with 11 - to - 12 Mapping ($N_{nn} = 1$ and $N_{row} = 3$)			
FSM-State	Related STD-State(s)	Remark, or Limitations on Word **abcd**	Fan-Out
Σ_1	σ_1 (A)	$abc \leq 172$	2057
Σ_2	σ_1 (B)	$172 \leq abc \leq 377$	2078
Σ_3	σ_1 (C)	$400 \leq abc \leq 617$	2054
Σ_4	σ_1 (D)	$abc \geq 620$	2119
Σ_5	σ_2 (A), σ_5 (A)	$a = 0$ or $200 \leq abc \leq 260$	2233
Σ_6	σ_2 (B), σ_5 (B)	$260 \leq abc \leq 477$	2137
Σ_7	σ_2 (C), σ_5 (C)	$a = 6$ or $a = 7$	2160
Σ_8	σ_2 (D)	$a = 1$ or $a = 5$	2160
Σ_9	σ_4 (A), σ_9 (A)	via mirroring from Σ_5	2233
Σ_{10}	σ_4 (B), σ_9 (B)	via mirroring from Σ_6	2137
Σ_{11}	σ_4 (C), σ_9 (C)	via mirroring from Σ_7	2160
Σ_{12}	σ_4 (D)	via mirroring from Σ_8	2160
Σ_{13}	σ_3 (A), σ_6 (A), σ_8 (A), σ_{10} (A)	$a = 2$ ($abc \neq 275$, $abc \neq 277$), or $a = 3$	2121
Σ_{14}	σ_3 (B), σ_6 (B), σ_8 (B)	$a = 1$ or $a = 6$	2217
Σ_{15}	σ_3 (C), σ_8 (C), σ_{10} (B)	$a = 0$ or $a = 7$ or $abc = 275$ or $abc = 277$	2053
Σ_{16}	σ_6 (C)	via mirroring from Σ_{15}	2053

FIG.16

11- to -12 Fish-Bone Main Code

user Word	Σ_1/Σ_9 Channel Word	NS	Σ_2/Σ_{10} Channel Word	NS	Σ_3/Σ_{11} Channel Word	NS	Σ_4/Σ_{12} Channel Word	NS	Σ_5/Σ_{13} Channel Word	NS	Σ_6/Σ_{14} Channel Word	NS	Σ_7/Σ_{15} Channel Word	NS	Σ_8/Σ_{16} Channel Word	NS
0	0010	5	1730	13	4001	13	6200	9	0010	1	2600	13	6001	5	1001	5
	0040	1	2300	13	3004	9	4004	9	2001	5	1001	13	0040	5	0040	5
1	0010	6	1730	14	4001	14	6200	10	0010	2	2600	14	6001	6	1001	6
	0040	2	2300	14	3004	10	4004	10	2001	6	1001	14	0040	6	0040	6
2	0010	7	1730	15	4001	16	6200	11	0010	3	2600	15	6001	7	1001	7
	0040	3	2300	15	3004	11	4004	11	2001	7	1001	16	0040	7	0040	7
3	0010	8	1732	1	4002	5	6200	12	0010	4	2601	9	6003	9	1003	9
	0040	4	2304	5	3006	5	4006	5	2003	9	1002	5	0040	8	0040	8
4	0012	9	1732	2	4002	6	6201	13	0011	4	2601	10	6003	10	1003	10
	0044	9	2304	6	3006	6	4006	6	2003	10	1002	6	0044	13	0044	13
5	0012	10	1732	3	4002	7	6201	14	0011	6	2601	11	6003	11	1003	11
	0044	10	2304	7	3006	7	4006	7	2003	11	1002	7	0044	14	0044	14
6	0012	11	1732	4	4002	8	6201	16	0011	7	2601	12	6003	12	1003	12
	0044	11	2304	8	3006	8	4006	8	2003	12	1002	8	0044	15	0044	15
7	0012	12	1733	5	4003	1	6202	5	0013	9	2602	1	6004	9	1004	9
	0046	5	2302	1	3001	5	4001	5	2004	9	1003	1	0042	9	0042	9
8	0013	13	1733	6	4003	2	6202	6	0013	10	2602	2	6004	10	1004	10
	0046	6	2302	2	3001	6	4001	6	2004	10	1003	2	0042	10	0042	10
....	....	..	....	..	....	..	....	..	....	..	....	..	....	..	....	..
2039	1722	8	3760	14	6173	11	7742	6	2456	11	4702	4	7705	9	5704	4
	2153	7	1702	4	7705	5	5701	4	3730	14	6637	5	7770	14	7770	14
2040	1723	1	3760	15	6173	12	7742	7	2457	13	4703	5	7705	10	5705	5
	2157	13	1706	9	7705	6	5705	9	3730	15	6637	6	7770	15	7770	15
2041	1723	2	3761	9	6174	9	7742	8	2457	15	4703	6	7705	11	5705	6
	2157	15	1706	10	7705	7	5705	10	3732	1	6637	7	7772	1	7772	1
2042	1723	3	3761	10	6174	10	7743	1	2460	5	4703	7	7706	1	5705	7
	2130	9	1706	11	7703	1	5705	11	3732	2	6660	9	7772	2	7772	2
2043	1723	4	3761	11	6174	11	7743	2	2460	6	4704	5	7706	2	5706	13
	2130	10	1701	9	7703	2	5703	13	3732	3	6660	10	7772	3	7772	3
2044	1724	1	3761	12	6175	13	7743	3	2460	7	4704	6	7706	3	5706	14
	2130	11	1701	10	7703	3	5703	14	3732	4	6660	11	7772	4	7772	4
2045	1724	2	3762	1	6175	15	7743	4	2460	8	4704	7	7706	4	5706	15
	2130	12	1701	11	7703	4	5703	16	3733	5	6660	12	7776	9	7776	9
2046	1724	3	3762	2	6176	5	7746	13	2461	1	4704	8	7707	5	5707	9
	2134	1	1701	12	7707	9	5707	5	3733	6	6661	13	7776	10	7776	10
2047	1724	4	3762	3	6176	6	7746	14	2461	2	4705	1	7707	6	5707	10
	2134	2	1705	1	7707	10	5707	6	3733	7	6661	14	7776	11	7776	11

FIG.17

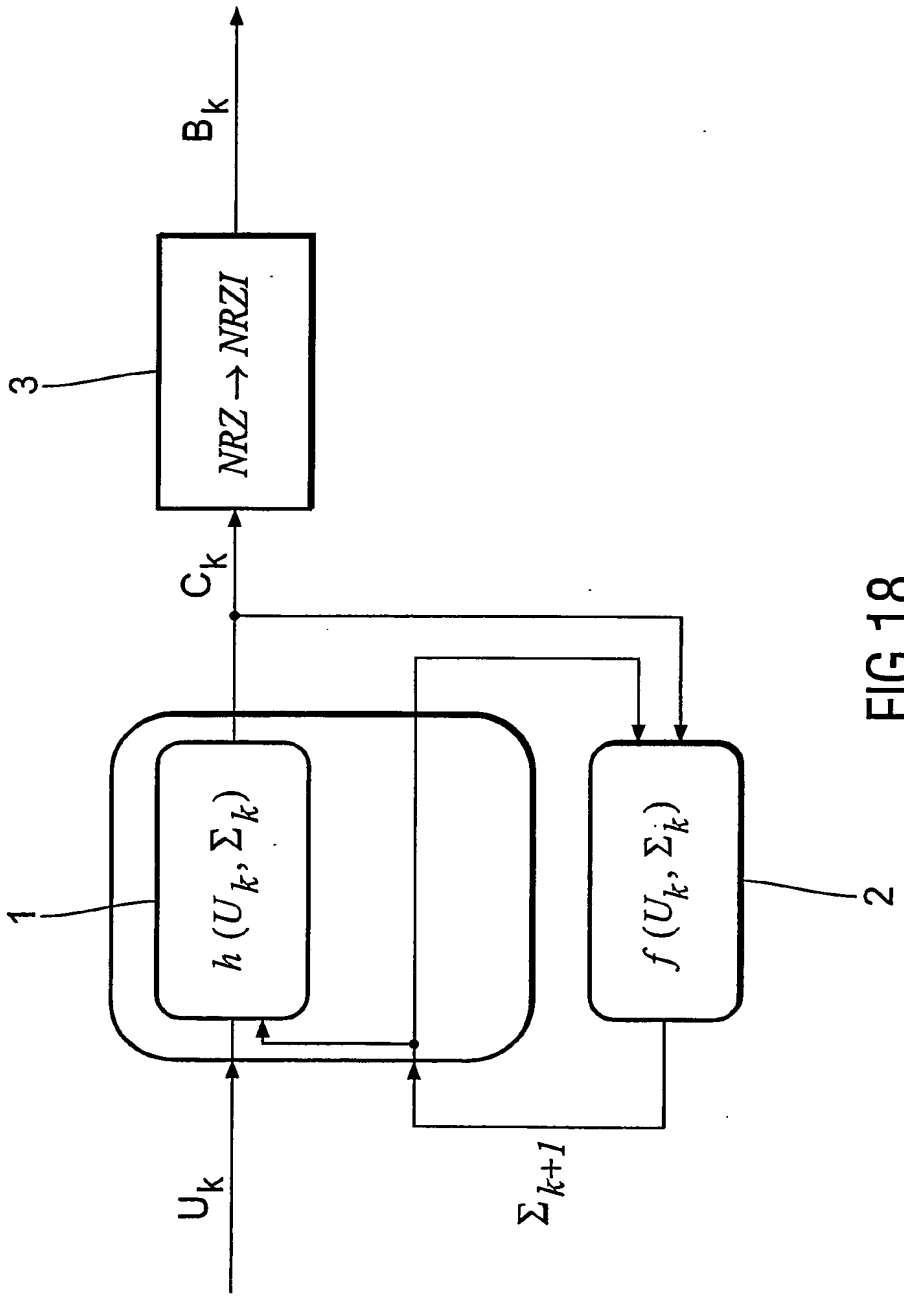
B_k
3
$NRZ \rightarrow NRZI$
C_k
1
$h(U_k, \Sigma_k)$
$f(U_k, \Sigma_k)$
2
U_k
Σ_{k+1}

FIG.18

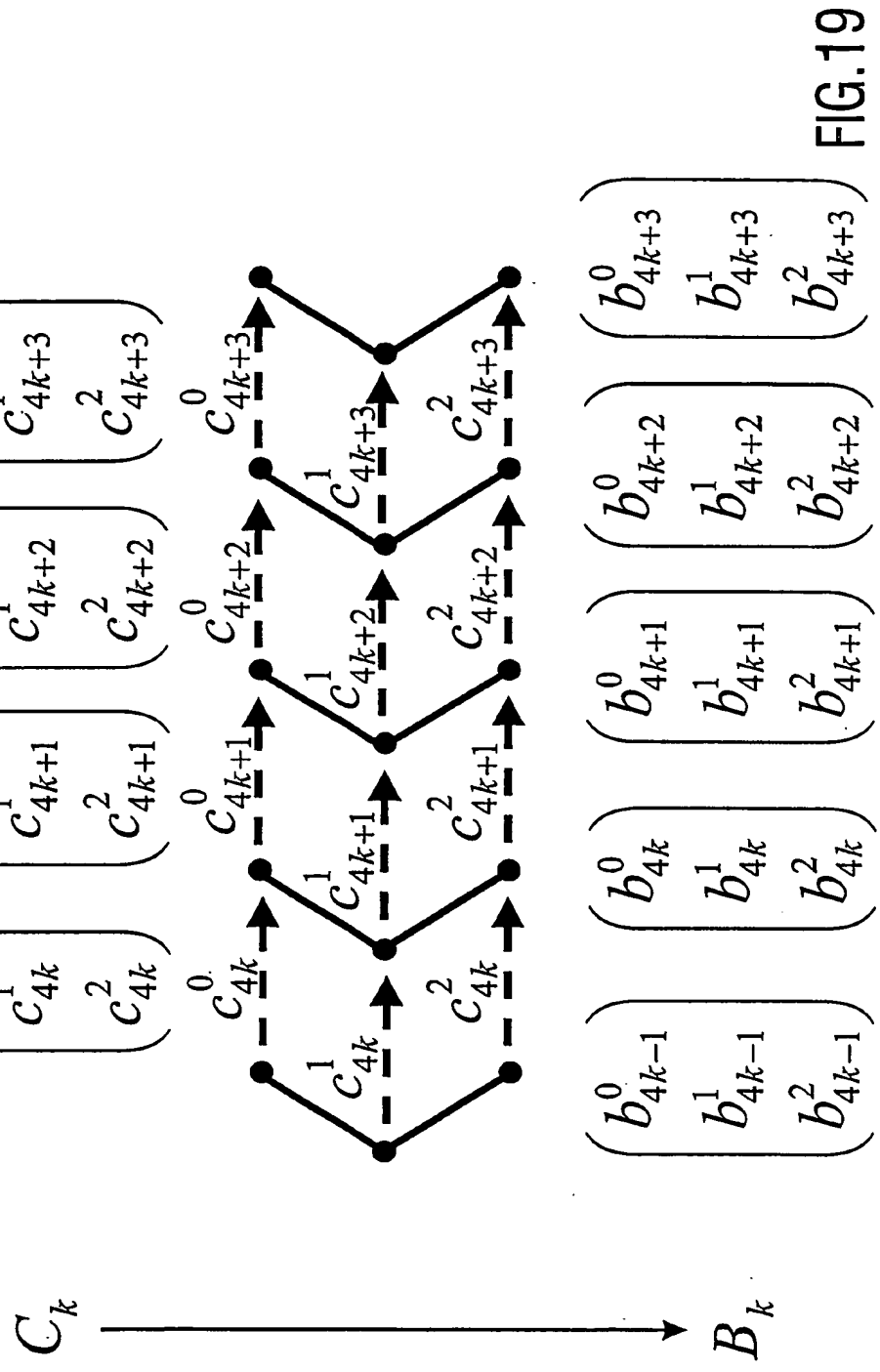
C_k
B_k
$\begin{pmatrix} c^0_{4k} \\ c^1_{4k} \\ c^2_{4k} \end{pmatrix}$
$\begin{pmatrix} c^0_{4k+1} \\ c^1_{4k+1} \\ c^2_{4k+1} \end{pmatrix}$
$\begin{pmatrix} c^0_{4k+2} \\ c^1_{4k+2} \\ c^2_{4k+2} \end{pmatrix}$
$\begin{pmatrix} c^0_{4k+3} \\ c^1_{4k+3} \\ c^2_{4k+3} \end{pmatrix}$
$\begin{pmatrix} b^0_{4k-1} \\ b^1_{4k-1} \\ b^2_{4k-1} \end{pmatrix}$
$\begin{pmatrix} b^0_{4k} \\ b^1_{4k} \\ b^2_{4k} \end{pmatrix}$
$\begin{pmatrix} b^0_{4k+1} \\ b^1_{4k+1} \\ b^2_{4k+1} \end{pmatrix}$
$\begin{pmatrix} b^0_{4k+2} \\ b^1_{4k+2} \\ b^2_{4k+2} \end{pmatrix}$
$\begin{pmatrix} b^0_{4k+3} \\ b^1_{4k+3} \\ b^2_{4k+3} \end{pmatrix}$

FIG.19

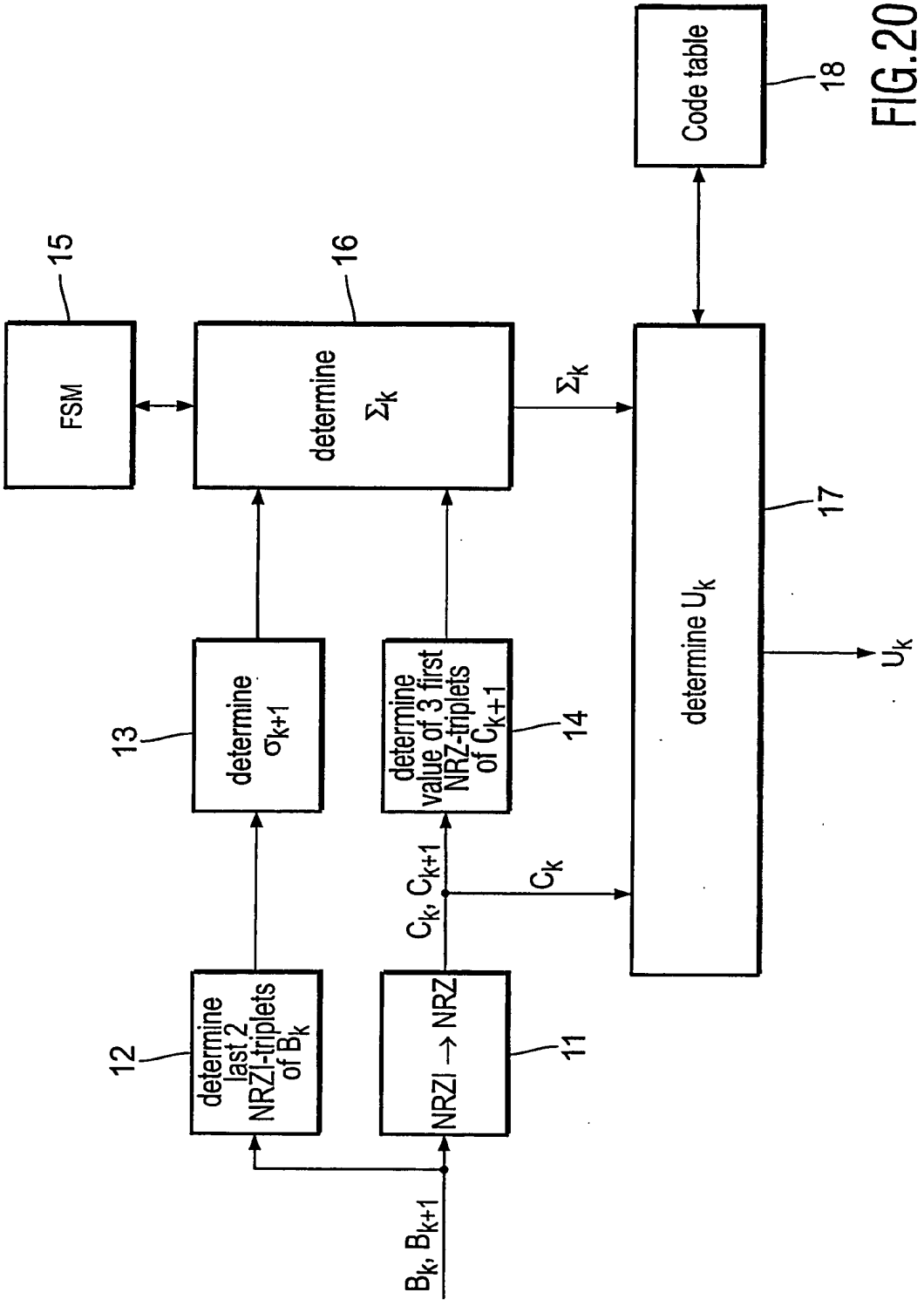
Code table
18
FSM
15
determine Σ_k
16
Σ_k
determine U_k
17
U_k
determine σ_{k+1}
13
determine value of 3 first NRZ-triplets of C_{k+1}
14
C_k, C_{k+1}
C_k
determine last 2 NRZI-triplets of B_k
12
NRZI → NRZ
11
B_k, B_{k+1}

FIG.20

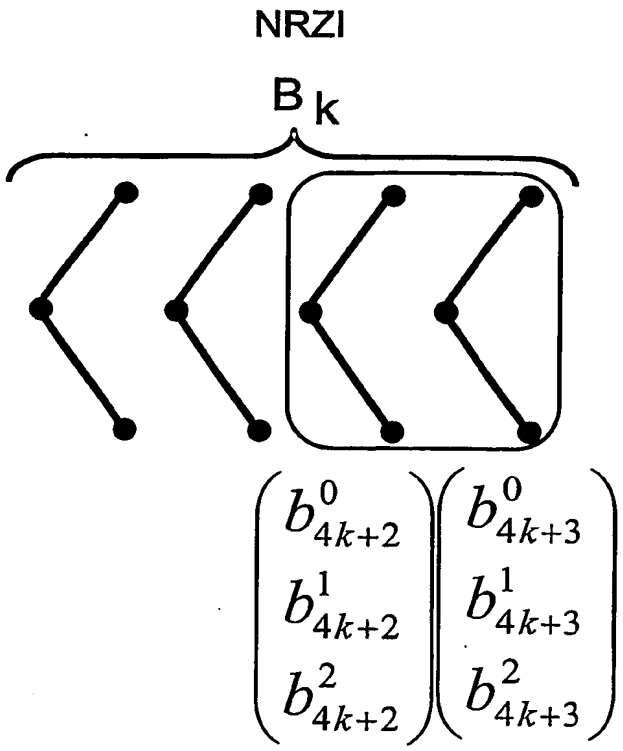
NRZI
B k
b^0_{4k+2} b^0_{4k+3}
b^1_{4k+2} b^1_{4k+3}
b^2_{4k+2} b^2_{4k+3}

FIG.21

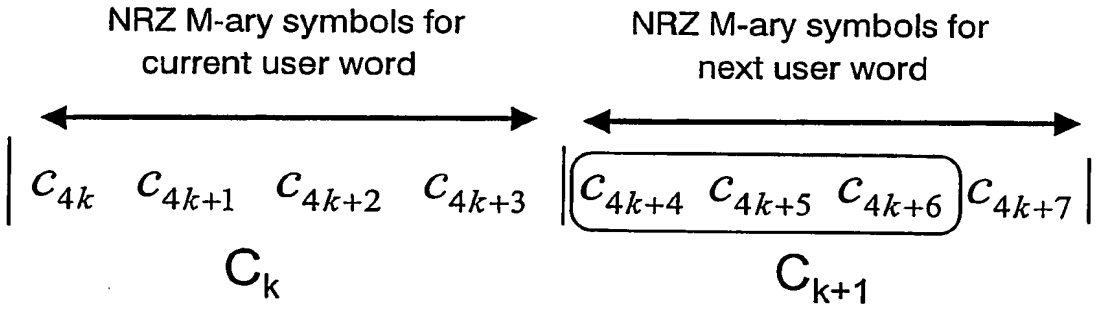
NRZ M-ary symbols for current user word
NRZ M-ary symbols for next user word
c_{4k} c_{4k+1} c_{4k+2} c_{4k+3}
c_{4k+4} c_{4k+5} c_{4k+6} c_{4k+7}
C k
C k+1

FIG.22

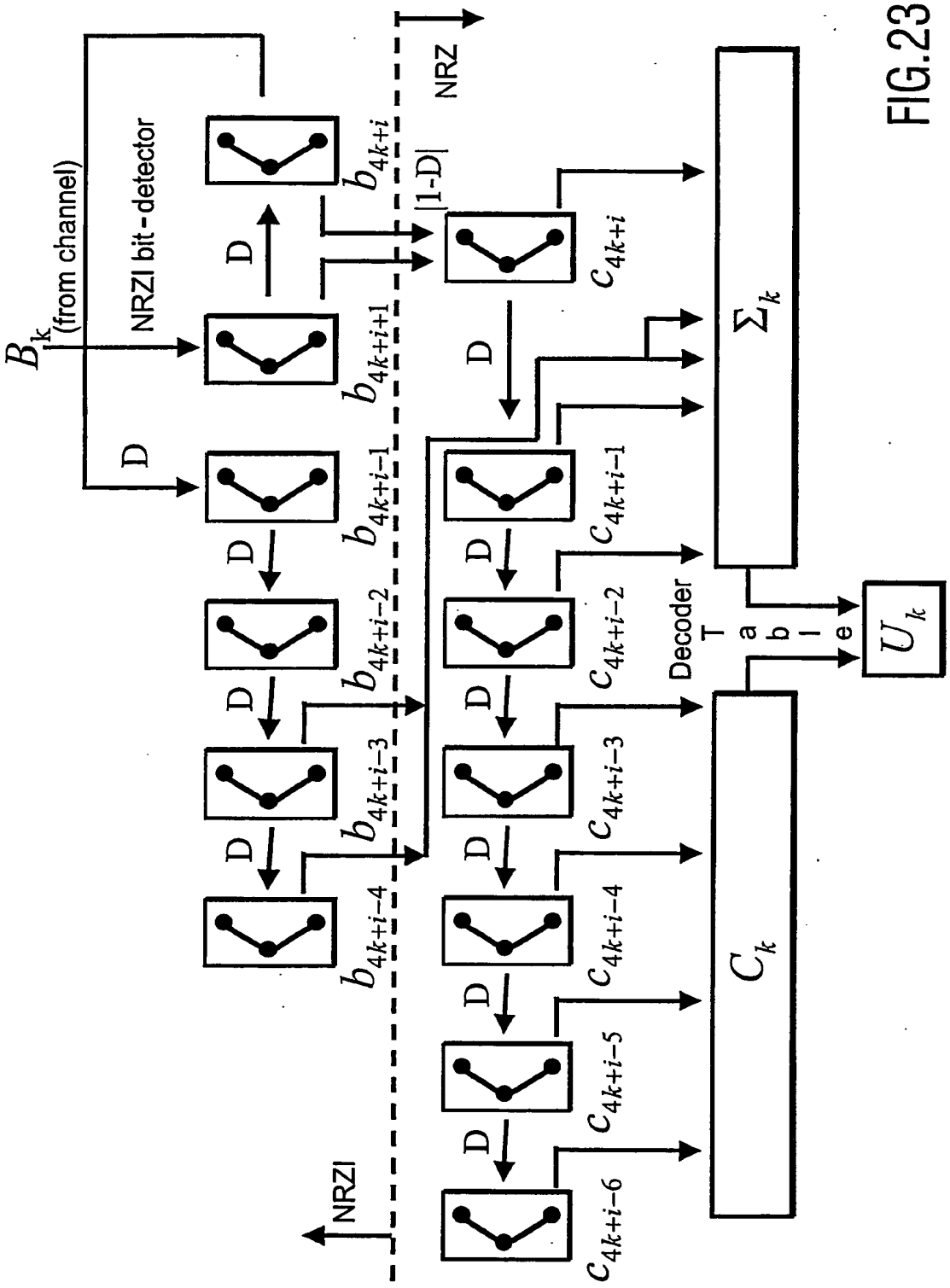
B_k
(from channel)
NRZI bit-detector
D
NRZ
|1-D|
NRZI
Decoder
T
a
b
l
e
Σ_k
C_k
U_k
b_{4k+i}
b_{4k+i+1}
b_{4k+i-1}
b_{4k+i-2}
b_{4k+i-3}
b_{4k+i-4}
c_{4k+i}
c_{4k+i-1}
c_{4k+i-2}
c_{4k+i-3}
c_{4k+i-4}
c_{4k+i-5}
c_{4k+i-6}

FIG.23

Row-Based RDS for a Fish-Bone Code (with bipolar NRZI channel bits $u_j^{(l)}$)
$\cdots \quad u_{i-2}^{(1)} \quad u_{i-1}^{(1)} \quad u_i^{(1)} \rightarrow \mathrm{RDS}_i^{(1)} = \Sigma_{j=-\infty}^{i} u_j^{(1)}$
$/ \qquad / \qquad /$
$\cdots \; u_{i-2}^{(2)} \quad u_{i-1}^{(2)} \quad u_i^{(2)} \rightarrow \mathrm{RDS}_i^{(2)} = \Sigma_{j=-\infty}^{i} u_j^{(2)}$
$\backslash \qquad \backslash \qquad \backslash$
$\cdots \quad u_{i-2}^{(3)} \quad u_{i-1}^{(3)} \quad u_i^{(3)} \rightarrow \mathrm{RDS}_i^{(3)} = \Sigma_{j=-\infty}^{i} u_j^{(3)}$

FIG.24

Parity-Vector p for a Channel Word of 3 8-ary Symbols (with NRZ channel bits $\alpha_j^{(l)}$)	
$\alpha_1^{(1)} \quad \alpha_2^{(1)} \quad \alpha_3^{(1)} \rightarrow p^{(1)} = \Sigma_{j=1}^{3} \alpha_j^{(1)}$	mod 2
$/ \qquad / \qquad /$	
$\alpha_1^{(2)} \quad \alpha_2^{(2)} \quad \alpha_3^{(2)} \rightarrow p^{(2)} = \Sigma_{j=1}^{3} \alpha_j^{(2)}$	mod 2
$\backslash \qquad \backslash \qquad \backslash$	
$\alpha_1^{(3)} \quad \alpha_2^{(3)} \quad \alpha_3^{(3)} \rightarrow p^{(3)} = \Sigma_{j=1}^{3} \alpha_j^{(3)}$	mod 2

FIG.25

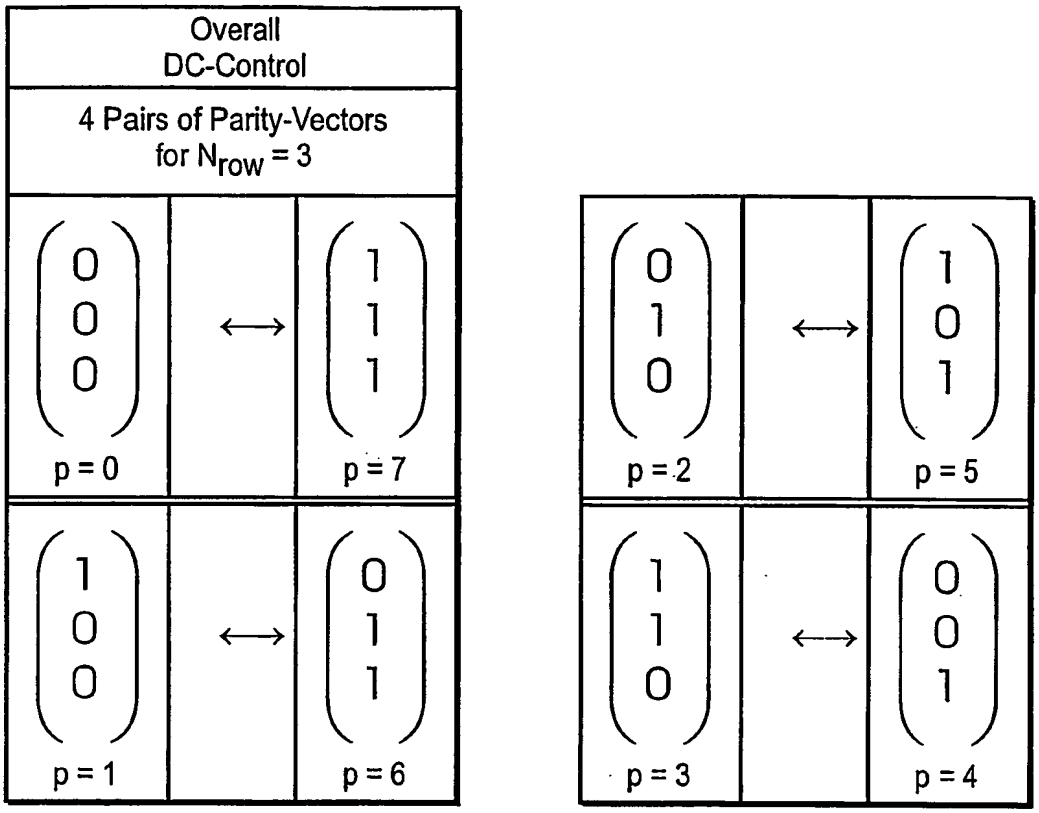
Overall
DC-Control
4 Pairs of Parity-Vectors
for N_{row} = 3
0 0 0
p = 0
1 1 1
p = 7
0 1 0
p = 2
1 0 1
p = 5
1 0 0
p = 1
0 1 1
p = 6
1 1 0
p = 3
0 0 1
p = 4

FIG.26

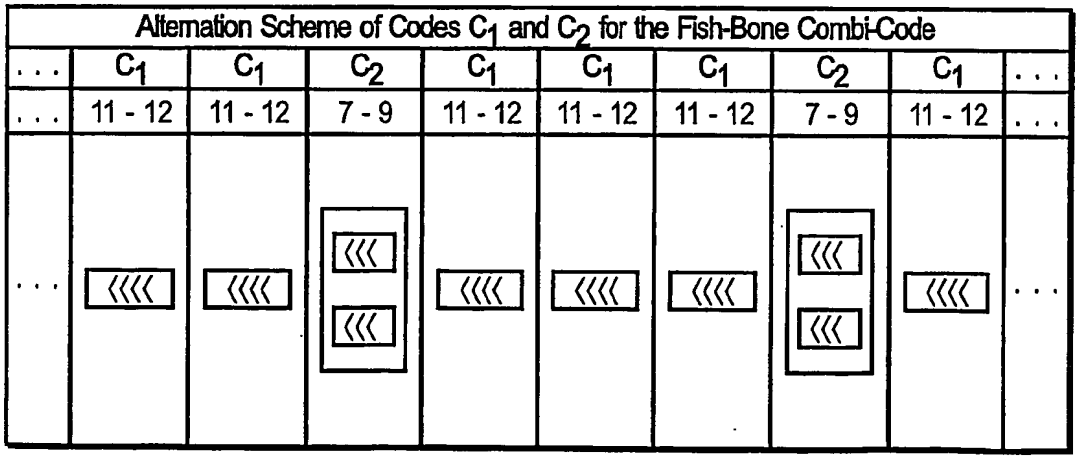
Alternation Scheme of Codes C_1 and C_2 for the Fish-Bone Combi-Code
C_1 C_1 C_2 C_1 C_1 C_1 C_2 C_1
11 - 12 11 - 12 7 - 9 11 - 12 11 - 12 11 - 12 7 - 9 11 - 12

FIG.27

16-State FSM 7 - to - 9 Fish-Bone Substitution Code (N_{nn} = 1 and N_{row} = 3)			
FSM-State	Related STD-State(s)	Remark, or Limitations on Word abcd	Fan-Out
Σ_1	σ_1 (A)	abc ≤ 177	138
Σ_2	σ_1 (B)	177 ≤ abc ≤ 372	130
Σ_3	σ_1 (C)	372 ≤ abc ≤ 617	132
Σ_4	σ_1 (D)	abc ≥ 620	132
Σ_5	σ_2 (A), σ_5 (A)	a = 0 or 200 ≤ abc ≤ 260	145
Σ_6	σ_2 (B), σ_5 (B)	260 ≤ abc ≤ 477	142
Σ_7	σ_2 (C), σ_5 (C)	a = 6 or a = 7	142
Σ_8	σ_2 (D)	a = 1 or a = 5	141
Σ_9	σ_4 (A), σ_9 (A)	via mirroring from Σ_5	145
Σ_{10}	σ_4 (B), σ_9 (B)	via mirroring from Σ_6	142
Σ_{11}	σ_4 (C), σ_9 (C)	via mirroring from Σ_7	141
Σ_{12}	σ_4 (D)	via mirroring from Σ_8	142
Σ_{13}	σ_3 (A), σ_6 (A), σ_8 (A), σ_{10} (A)	a = 2 (abc ≠ 275, abc ≠ 277), or a = 3	138
Σ_{14}	σ_3 (B), σ_6 (B), σ_8 (B)	a = 1 or a = 6	155
Σ_{15}	σ_3 (C), σ_8 (C), σ_{10} (B)	a = 0 or a = 7 or abc = 275 or abc = 277	145
Σ_{16}	σ_6 (C)	via mirroring from Σ_{15}	145

FIG.28

7 - to - 9 Fish-Bone Substitution Code

Symbol		Parity	Σ_1/Σ_9 Channel Word	NS	Σ_2/Σ_{10} Channel Word	NS	Σ_3/Σ_{11} Channel Word	NS	Σ_4/Σ_{12} Channel Word	NS	Σ_5/Σ_{13} Channel Word	NS	Σ_6/Σ_{14} Channel Word	NS	Σ_7/Σ_{15} Channel Word	NS	Σ_8/Σ_{16} Channel Word	NS
0	Σ_1-Σ_8	p_1	001	5	200	13	373	1	620	9	001	1	260	13	600	1	100	1
		p_2	006	5	207	13	404	1	627	9	006	1	267	13	607	1	107	1
	Σ_9-Σ_{16}	p_1	004	1	230	13	300	1	400	1	200	1	100	9	004	5	004	5
		p_2	003	1	237	13	307	1	407	1	207	1	107	9	003	5	003	5
1	Σ_1-Σ_8	p_1	001	7	200	15	373	3	620	11	001	3	260	15	600	3	100	3
		p_2	006	7	207	15	404	3	627	11	006	3	267	15	607	3	107	3
	Σ_9-Σ_{16}	p_1	004	3	230	15	300	3	400	3	200	3	100	11	004	7	004	7
		p_2	003	3	237	15	307	3	407	3	207	3	107	11	003	7	003	7
2	Σ_1-Σ_8	p_1	003	10	201	10	376	13	621	13	002	9	261	10	601	5	101	5
		p_2	004	10	206	10	401	13	626	13	005	9	266	10	606	5	106	5
	Σ_9-Σ_{16}	p_1	002	5	234	6	304	9	404	9	201	5	101	13	002	1	002	1
		p_2	005	5	233	6	303	9	403	9	206	5	106	13	005	1	005	1
3	Σ_1-Σ_8	p_1	003	12	201	12	376	15	621	16	002	11	261	12	601	7	101	7
		p_2	040	12	242	12	410	15	651	16	005	11	301	12	606	7	106	7
	Σ_9-Σ_{16}	p_1	002	7	234	8	304	11	404	11	201	7	101	16	002	3	002	3
		p_2	005	7	604	8	303	11	403	11	206	7	153	16	005	3	005	3
4	Σ_1-Σ_8	p_1	003	11	202	2	377	10	622	6	003	13	262	2	603	10	103	10
		p_2	004	11	205	2	400	10	625	6	004	13	302	2	604	10	104	10
	Σ_9-Σ_{16}	p_1	006	13	232	2	306	6	406	6	203	10	102	6	006	9	006	9
		p_2	001	13	602	2	301	6	401	6	204	10	105	6	001	9	001	9
...	.....	...	...	..	...	..	...	..	...	..	...	..	...	..	...	..	...	..
124	Σ_1-Σ_8	p_1	056	11	357	6	536	4	756	11	226	1	363	4	737	15	153	6
		p_2	163	11	350	6	610	4	762	11	230	1	463	4	730	15	572	6
	Σ_9-Σ_{16}	p_1	242	3	672	2	720	8	542	1	343	5	170	11	762	7	762	7
		p_2	223	3	172	2	736	8	532	1	377	5	625	11	703	7	703	7
125	Σ_1-Σ_8	p_1	142	2	360	13	602	9	750	13	205	5	430	6	740	14	147	10
		p_2	176	2	354	13	425	9	757	13	231	5	462	6	703	14	577	10
	Σ_9-Σ_{16}	p_1	016	10	672	4	760	14	560	1	346	9	626	1	725	15	725	15
		p_2	264	10	136	4	710	14	576	1	363	9	630	1	700	15	700	15
126	Σ_1-Σ_8	p_1	143	5	360	15	602	11	762	10	227	5	432	9	702	10	530	3
		p_2	177	5	367	15	605	11	765	10	246	5	406	9	741	10	573	3
	Σ_9-Σ_{16}	p_1	227	10	160	9	721	1	560	4	346	11	626	3	723	12	723	12
		p_2	213	10	132	9	773	1	576	4	363	11	612	3	760	12	760	12
127	Σ_1-Σ_8	p_1	146	9	350	8	602	10	763	13	227	7	432	11	740	13	531	5
		p_2	172	9	346	8	605	10	764	13	257	7	460	11	747	13	536	5
	Σ_9-Σ_{16}	p_1	260	1	160	11	714	6	564	10	340	13	627	5	166	14	766	14
		p_2	267	1	176	11	713	6	572	10	347	13	613	5	770	14	770	14

FIG.29

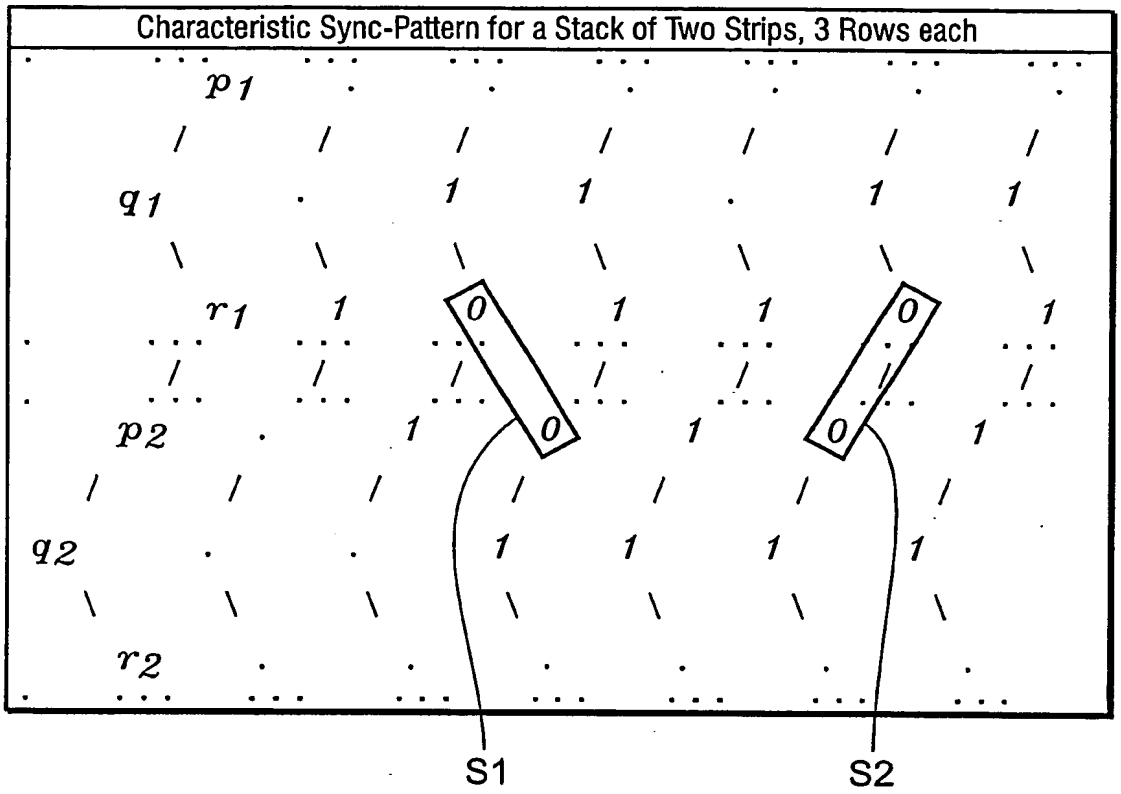
Characteristic Sync-Pattern for a Stack of Two Strips, 3 Rows each
p1
q1
r1
p2
q2
r2
S1
S2

FIG.30

Begin Sync Σ_1 Top-Strip		
	NRZ Symbol 0 4	
1	1	1
/	/	/
1	1	1
\	\	\
1	1	0

Begin Sync Σ_2 Top-Strip		
	NRZ Symbol 3 7	
1	0	1
/	/	/
1	0	1
\	\	\
1	1	0

Begin Sync Σ_3 Top-Strip		
	NRZ Symbol 4 7	
1	1	0
/	/	/
1	1	0
\	\	\
1	0	1

Begin Sync Σ_4 Top-Strip		
	NRZ Symbol 7 4	
1	0	0
/	/	/
1	0	0
\	\	\
1	0	1

FIG.31A

Begin Sync Σ_5 Top-Strip		
	NRZ Symbol 0	5
1	1	0
/	/	/
0	0	0
\	\	\
0	0	1

Begin Sync Σ_6 Top-Strip		
	NRZ Symbol 3	6
1	0	0
/	/	/
0	1	0
\	\	\
0	0	1

Begin Sync Σ_7 Top-Strip		
	NRZ Symbol 7	5
1	0	1
/	/	/
0	1	1
\	\	\
0	1	0

Begin Sync Σ_8 Top-Strip		
	NRZ Symbol 5	7
1	0	1
/	/	/
0	0	1
\	\	\
0	1	0

Begin Sync Σ_9 Top-Strip		
	NRZ Symbol 0	7
1	1	0
/	/	/
1	1	0
\	\	\
0	0	1

Begin Sync Σ_{10} Top-Strip		
	NRZ Symbol 6	6
1	1	1
/	/	/
1	0	1
\	\	\
0	1	0

FIG.31B

Begin Sync Σ_{11} Top-Strip		
	NRZ Symbol 7	7
1	0	1
1	0	1
0	1	0

Begin Sync Σ_{12} Top-Strip		
	NRZ Symbol 5	5
1	0	1
1	1	1
0	1	0

Begin Sync Σ_{13} Top-Strip		
	NRZ Symbol 3	5
1	0	1
0	1	1
1	1	0

Begin Sync Σ_{14} Top-Strip		
	NRZ Symbol 0	6
1	1	1
0	0	1
1	1	0

Begin Sync Σ_{15} Top-Strip		
	NRZ Symbol 7	6
1	0	0
0	1	0
1	0	1

Begin Sync Σ_{16} Top-Strip		
	NRZ Symbol 7	6
1	0	0
0	1	0
1	0	1

FIG.31C

Begin Sync Σ_1 Bottom-Strip			
	NRZ Symbol		
	0	0 (7)	1 (5)
1	1	1	0
1	1	1	1
1	1	1	1

Begin Sync Σ_2 Bottom-Strip			
	NRZ Symbol		
	3	0 (7)	5 (1)
1	0	0	1
1	0	0	0
1	1	1	0

Begin Sync Σ_3 Bottom-Strip			
	NRZ Symbol		
	4	0 (7)	5 (1)
1	1	1	0
1	1	1	1
1	0	0	1

Begin Sync Σ_4 Bottom-Strip			
	NRZ Symbol		
	7	0 (7)	1 (5)
1	0	0	1
1	0	0	0
1	0	0	0

FIG.32A

Begin Sync Σ_5 Bottom-Strip			
	NRZ Symbol		
	0	0 (7)	7 (3)
1	1	1	0
0	0	0	1
0	0	0	1

Begin Sync Σ_6 Bottom-Strip			
	NRZ Symbol		
	3	0 (7)	3 (7)
1	0	0	1
0	1	1	0
0	0	0	0

Begin Sync Σ_7 Bottom-Strip			
	NRZ Symbol		
	7	0 (7)	7 (3)
1	0	0	1
0	1	1	0
0	1	1	0

Begin Sync Σ_8 Bottom-Strip			
	NRZ Symbol		
	5	0 (7)	5 (1)
1	0	0	1
0	0	0	0
0	1	1	0

FIG.32B

Begin Sync Σ_9 Bottom-Strip			
	NRZ Symbol		
	0	0 (7)	5 (1)
1	1	1	0
1	1	1	1
0	0	0	1

Begin Sync Σ_{10} Bottom-Strip			
	NRZ Symbol		
	6	0 (7)	3 (7)
1	1	1	0
1	0	0	1
0	1	1	1

Begin Sync Σ_{11} Bottom-Strip			
	NRZ Symbol		
	7	0 (7)	5 (1)
1	0	0	1
1	0	0	0
0	1	1	0

Begin Sync Σ_{12} Bottom-Strip			
	NRZ Symbol		
	5	0 (7)	7 (3)
1	0	0	1
1	1	1	0
0	1	1	0

Begin Sync Σ_{13} Bottom-Strip			
	NRZ Symbol		
	3	0 (7)	7 (3)
1	0	0	1
0	1	1	0
1	1	1	0

Begin Sync Σ_{14} Bottom-Strip			
	NRZ Symbol		
	0	0 (7)	3 (7)
1	1	1	0
0	0	0	1
1	1	1	1

FIG.32C

Begin Sync Σ_{15} Bottom-Strip			
	NRZ Symbol		
	7	0 (7)	3 (7)
1	0	0	1
/	/	/	/
0	1	1	0
\	\	\	\
1	0	0	0

Begin Sync Σ_{16} Bottom-Strip			
	NRZ Symbol		
	7	0 (7)	3 (7)
1	0	0	1
/	/	/	/
0	1	1	0
\	\	\	\
1	0	0	0

FIG.32D

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